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A3-277
METROLOGY
LABORATORY

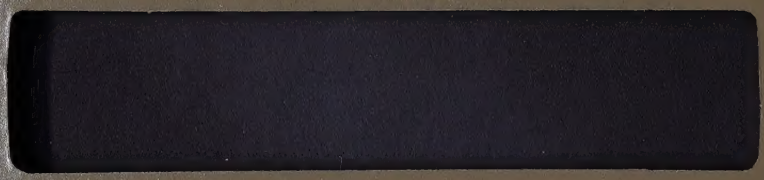
MODEL 115
AMPLITUDE MODULATOR

Operating INSTRUCTIONS

Electronic Services - Los Angeles
M14053X

MP MASTER
MA24281

MEASUREMENTS
A McGRAW-EDISON DIVISION
BOONTON NEW JERSEY



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MODEL 115
AMPLITUDE MODULATOR

Operating INSTRUCTIONS

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Additional information with regard to the applications and maintenance of this equipment will be available from time to time. Users of the Model 115 Amplitude Modulator are urged to discuss their problems with us and to suggest such modifications as might make the instrument more adaptable to their special requirements.

Maintenance difficulties should be reported to Measurements Corporation before proceeding with actual repairs, since, through our familiarity with the instrument we are able to suggest the appropriate repair procedure.

Engineering Department

MEASUREMENTS CORPORATION

Boonton, New Jersey

U. S. A.

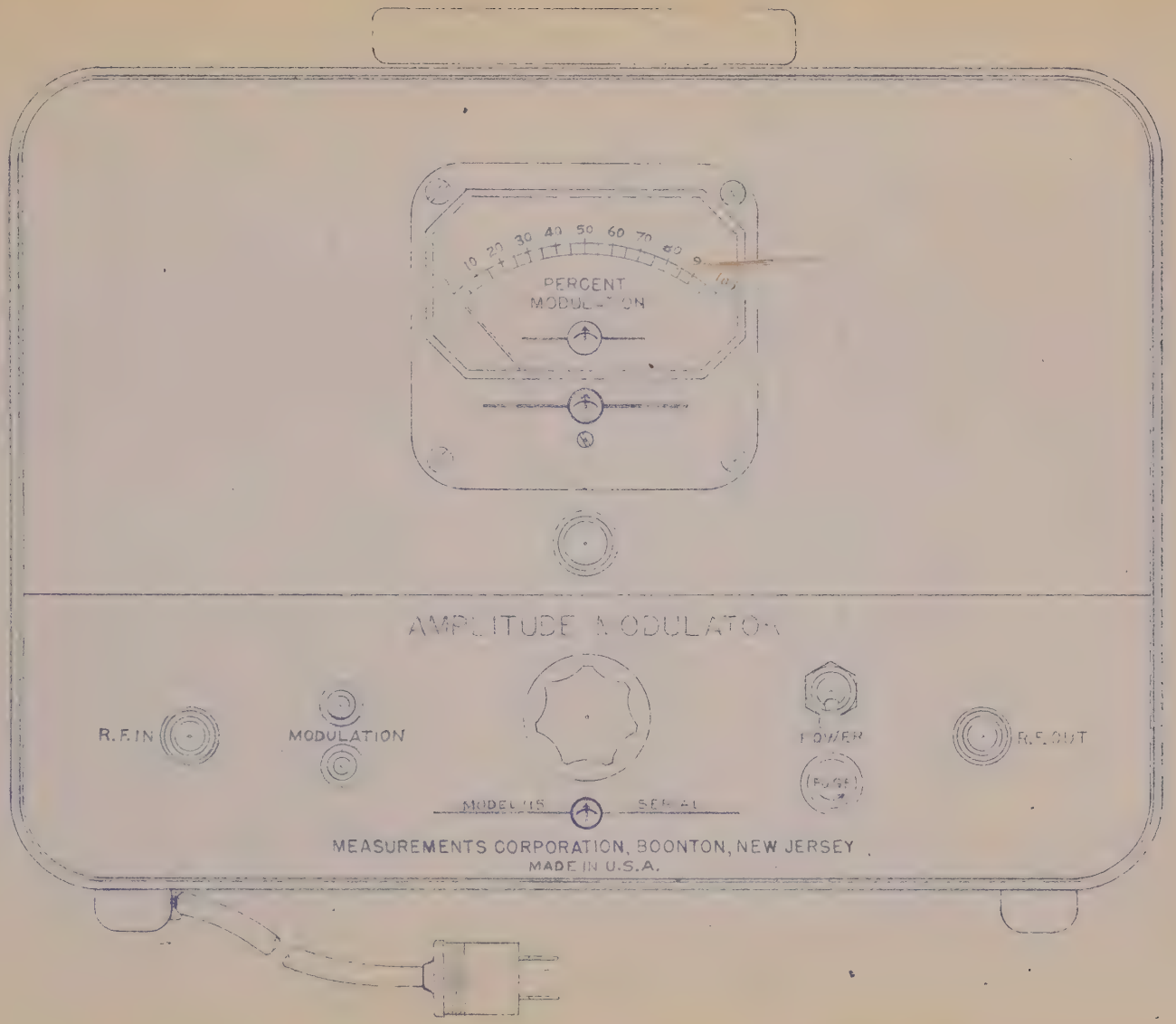

Figure 1. Model 115 Amplitude Modulator

CHAPTER 1

INTRODUCTION

SECTION I

GENERAL

1. SCOPE OF MANUAL

a. This manual describes the basic operation, construction and maintenance of the Model 115 Amplitude Modulator. Following the text of the manual are two appendices. Appendix I describes the recommended procedure for preparing the instrument for prolonged storage or reshipment. Appendix II contains an Identification Table of Replaceable Parts, listing reference symbols, name and description, function and drawing number of each part required for maintenance.

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SECTION II

DESCRIPTION AND DATA

2. GENERAL

a. The Model 115 Amplitude Modulator consists of an input audio amplifier, a balanced modulator, and a monitoring vacuum-tube voltmeter calibrated in percent modulation. The modulator operates over a carrier frequency range of 0.1 to 50 megacycles with external modulation frequencies of 30 cycles to 15 kilocycles. The percent modulation is essentially independent of the input carrier amplitude, of the carrier frequency and of the frequency of the modulating voltage. The Model 115 provides 100% amplitude modulation with low envelope distortion and negligible incidental frequency modulation. It is an indispensable instrument for making measurements on systems requiring up to 100% modulation and on narrow-band receivers where incidental fm cannot be tolerated.

b. (1) This modulator is simple to use since no cathode-ray oscilloscope is required for modulation depth or bias adjustments. A single control on the panel sets the percent modulation as indicated on the panel meter. The modulator is aperiodic and has an output impedance of 50 ohms with a low VSWR.

(2) The Amplitude Modulator may be used with any conventional a-m or f-m signal generator and an audio oscillator capable of producing approximately 10 volts across 100,000 ohms. It is particularly convenient to use the Model 115 with Measurements Model 82 Standard Signal Generator since this instrument provides both the carrier and the modulating source in one convenient case. NOTE: Paragraph 18a describes how the audio frequency and the carrier frequency may be obtained simultaneously from the Model 82.

3. TECHNICAL CHARACTERISTICS

a. CARRIER FREQUENCY RANGE:

(1) 100 kilocycles to 50 megacycles with a translation gain of approximately 0.1.

(2) When driven by a 50 ohm source, the frequency response is flat within ± 1 db from 1 Mc to 50 Mcs, and is down approximately 3 db at 100 kc.

b. MODULATION FREQUENCY RANGE:

(1) Flat within ± 5% from 30 cycles to 15 kilocycles.

(2) Approximately 10 volts across 100,000 ohms required for 100% modulation.

c. MODULATION CHARACTERISTICS:

(1) Amplitude modulation of 0 to 100% with less than 3% envelope distortion at 100% modulation, decreasing with lower modulation percentage.

(2) The accuracy of the indicated percentage of modulation is ± 5% of full scale from 0 to 100%.

d. IMPEDANCE:

(1) Carrier Input Impedance is 50 ohms nominal.

(2) Carrier Output Impedance is 50 ohms with VSWR of 1.2.

(3) Type N coaxial connectors are used for carrier input and output. Binding posts with 3/4-inch spacing are used for modulation input.

e. FREQUENCY MODULATION:

(1) Incidental frequency modulation due to amplitude modulation is negligible.

f. CARRIER DISTORTION:

(1) Less than 10% carrier distortion for inputs up to 0.1 volt, decreasing with lower input voltages. Carrier input amplitudes up to 1 volt may be employed with a moderate increase in carrier distortion.

g. LEAKAGE:

(1) At least 50 db below carrier input level.

h. SPURIOUS FEEDTHROUGH:

(1) Spurious modulation products at the output are approximately 1 millivolt for 100% modulation at 15 kilocycles and decrease correspondingly with decrease in modulation level and modulating frequency. High-order harmonics of a 15-Kc modulating frequency in the pass band above 100 Kc are less than 50 microvolts.

i. POWER SUPPLY:

(1) 117 volts, 50 to 60 cycles.

(2) Power input 40 watts.

4. COMPONENTS SUPPLIED

TABLE I. TABLE OF COMPONENTS

Quan.	Description	Overall Dimensions			Unit Weight
		Height	Width	Depth	
1	Model 115 Amplitude Modulator	10-1/2"	14"	7-1/4"	15#
1	Manual of Operating Instructions				
2	Tubes, RETMA #6BC4, installed				
1	Tube, RETMA #6AL5, installed				
1	Tube, RETMA #12AU7, installed				
1	Tube, RETMA #6X4, installed				
1	Tube, RETMA #0A2 installed				

5. EXPORT PACKAGING

a. Packed for export, the Model 115 is crated in a wooden box.

TABLE II. EXPORT PACKAGING DATA

Number of Packages	Dimensions			Weight	Volume Cu. Ft.
	Height	Width	Depth		
1	17"	22"	17"	50#	3.7

CHAPTER 2

OPERATING INSTRUCTIONS

SECTION I

SERVICE UPON RECEIPT OF EQUIPMENT

6. UNPACKING

a. Take care when unpacking or handling the equipment. Follow the procedure outlined below when unpacking the instrument.

(1) Place the carton in a location where it can be opened easily.

(2) Slit or open the carton taking due precaution not to mar the instrument.

(3) Lift the instrument from the carton and remove the paper wrapping.

(4) Inspect the case and controls on the front panel for possible damage during shipment.

7. PRELIMINARY PRECAUTIONS

a. Turn the knob below the meter fully counter-clockwise.

b. Connect the Model 115 to a power source of 117 volts, 50 to 60 c.p.s.

SECTION II

CONTROLS AND INSTRUMENTS

8. POWER

a. The POWER switch, S1, is located on the right-hand side of the front panel apron. This switch controls application of line voltage to the primary of the power transformer, T1.

b. The pilot light, E1, is located beneath the meter.

c. The fuse, F1, is located below the POWER switch.

9. CARRIER INPUT

a. The R.F. IN connector located on the left side of the front panel apron provides means for connecting an external carrier source of 100 kilocycles to 50 megacycles having a magnitude up to 1.0 volt.

10. MODULATING FREQUENCY INPUT

a. The MODULATION terminals located next to the R.F. IN connector provide means for connecting a modulating frequency source of 30 c.p.s. to 15 kilocycles. An amplitude of approximately 10 volts across 100,000 ohms, is required to modulate the carrier 100%.

11. MODULATED CARRIER OUTPUT

a. The R.F. OUT connector located on the right side of the panel apron is the modulated carrier output connector. For optimum performance, this connector should work into 50-ohm circuits.

12. PERCENT MODULATION

a. The PERCENT MODULATION meter indicates the percent modulation of the carrier by the modulating signal. The knob directly beneath the pilot light controls the percent modulation by varying the magnitude of the modulating signal. When this knob is in a full counter-clockwise position, the percent modulation is reduced to zero.

SECTION III

OPERATION

13. INSTALLATION AND ADJUSTMENT

a. The Model 115 Amplitude Modulator is a portable electronic test instrument which requires no permanent installation.

b. This instrument is to be used in conjunction with an auxiliary signal generator and an audio-frequency source.

14. PRELIMINARY OPERATIONAL CHECKS

a. Connect the line cord to a source of 117-volt, 50-60 c.p.s. power and place the POWER switch, S1, in the up position. The pilot light will indicate that the power is applied. Allow one minute for the tubes to warm up.

b. Rotate the knob located below the meter to its full counter-clockwise position.

c. Connect a signal generator to the R.F. IN connector and set the signal generator output for 10 millivolts to 1 volt at a frequency of 100 kilocycles (or any suitable carrier frequency within the range of an available cathode-ray oscilloscope).

d. Connect an audio oscillator to the MODULATION terminals, and set the output for approximately 10 volts at 1000 cycles. Paragraph 18a describes how audio frequency and the carrier frequency may be obtained simultaneously from the Model 82.

e. Connect the R.F. OUT connector to the vertical deflection input of a cathode-ray oscilloscope and shunt a 1/2 watt 50 ohm resistor across the vertical input terminals in order to provide the proper termination for the Model 115.

f. Connect the external synchronizing input of the oscilloscope to the audio oscillator.

g. Turn the knob on the Model 115 in a clockwise direction for an indicated percent modulation of 50%, for example, and adjust the oscilloscope for a properly synchronized image of the modulated wave. Next, turn the knob for an indicated 100% modulation. The wave viewed on the oscilloscope should be modulated 100% within an accuracy of $\pm$ 5%.

15. OPERATION AND USE

a. Set-up the Model 115 as described in Paragraph 14a through 14d.

b. Connect the R.F. OUT connector through a 50-ohm coaxial cable to the circuit or system to be tested. Optimum performance is obtained if the Model 115 works into a 50-ohm circuit.

c. Set the carrier and modulating frequencies to the desired values.

d. Set the percent modulation to the desired value by controlling the knob on the Model 115 and/or the output level of the modulating audio oscillator.

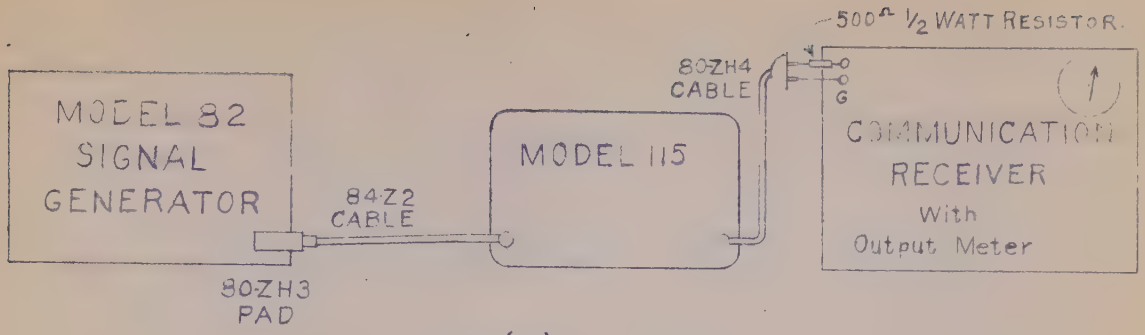
e. The percent modulation is essentially independent of the carrier input amplitude. However, it is recommended that carrier input amplitudes of 10 millivolts to 1 volt be employed and that attenuation be provided after modulation in order to minimize the relative magnitude of spurious modulation products. This can be done by connecting a pad such as the M-342 described in Paragraph 18c to the output connector, R.F. OUT, of the Model 115.

f. The translation gain of the Model 115 is approximately 0.1. The value of the translation gain at a particular frequency may be determined as follows:

(1) Arrange the test equipment as shown in Figure 2 (a). Set the carrier input frequency at the desired value and tune the receiver for a maximum reading. Set the signal generator and/or the receiver gain for a convenient reading on the receiver output meter. Record the output level of the signal generator and the reading of the receiver output meter.

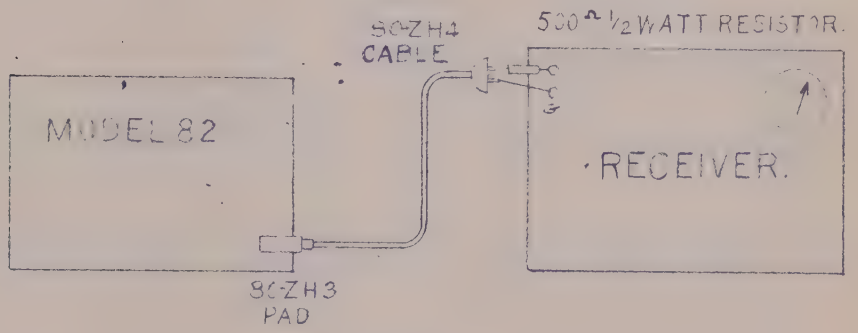
(2) Arrange the test equipment as shown in Figure 2 (b) with the carrier frequency at the same value as used in (1). Leave the receiver gain control at the same value as used in (1). Adjust the output level of the signal generator to the magnitude required to produce the same receiver output meter reading as in (1).

(3) The translation gain of the Model 115 is equal to the signal generator output level reading obtained in (2) divided by the signal generator output level reading obtained in (1).



(a)

NOTE: 80-ZH4 CABLE IS TERMINATED IN 50 OHMS. THE 500-OHM RESISTOR MAKES THIS TERMINATION INDEPENDENT OF RECEIVER INPUT IMPEDANCE.



(b)

FIGURE 2. MODEL 115 TRANSLATION GAIN MEASUREMENT.

CHAPTER 3

MAINTENANCE INSTRUCTIONS

SECTION I

MAINTENANCE

16. GENERAL:

a. Preventive maintenance procedure is not recommended for the Model 115. Preventive maintenance is a series of operations including inspection, adjustment, lubrication, etc., recommended periodically for certain types of equipment to eliminate the possibility of unexpected interruptions in service. Critical adjustments may be disturbed by too frequent inspection by personnel unfamiliar with the design of the Model 115. This may result in maladjustments causing errors in data that would be much more serious than an occasional operational failure.

b. If failure occurs, the instrument should be checked by the procedure outlined in Paragraph 14 (Preliminary Operational Checks), and if trouble other than a defective tube is indicated, the instrument should be returned to Measurements Corporation.

c. If the seal on the bottom of the instrument is broken without the permission of Measurements Corporation, the one-year guarantee will be void.

17. TUBE REPLACEMENT:

a. To remove the case of the Model 115, lay the instrument face down preferably on a soft pad, break the seal in the cup washer on the bottom of the case and remove the screw. Next, unscrew the four rubber feet taking care not to damage them. Finally, lift the case off of the instrument taking due care to feed the power cord through the hole in the bottom of the case.

b. The modulator tubes V1 and V2 (6BC4) are a pair of aged tubes which require a careful grid bias adjustment in order to obtain 100% modulation with a minimum of envelope distortion. In view of the fact that the customer may not have the necessary facilities to determine if this adjustment has been properly made, it is recommended that the Model 115 be returned to Measurements Corporation for service if V1 or V2 are replaced and the customer is unable to make the adjustments described in Paragraph 29.

c. If the modulator operates properly but there is no meter indication, either V5 (12AU7) or V6 (6AL5) may be defective. When these tubes are replaced, a minor readjustment of R12 (% MOD CAL.) may be necessary. This adjustment may be effected by setting up the equipment as described in Paragraph 14 and checking the 100% modulation condition.

d. Failure of tube V3 (6X4) or V4 (0A2) is immediately apparent by making standard power supply checks with a multimeter.

CHAPTER 4

EQUIPMENT USED IN CONJUNCTION WITH MODEL 115

SECTION I

ACCESSORIES

18. RECOMMENDED ACCESSORIES:

a. Measurements Corporation Model 82 Standard Signal Generator is particularly convenient to use with the Model 115, since it provides both the carrier frequency and the modulating frequency in one convenient case.

NOTE: In Model 82 instruments starting with Serial Number 607, the low-frequency output with a fixed level is available from the jack marked "EXT. L.F. IN-L.F. OSC OUT" simultaneously with the high-frequency output. (The L.F. GAIN control must be turned fully-counter-clockwise to insure that the high-frequency output of the Model 82 will be an unmodulated carrier). If the customer wishes to have an older instrument converted in this manner, this can be done by Measurements Corporation for a nominal charge.

Any carrier frequency source in the range of 100 kilocycles to 50 megacycles with an amplitude up to 1.0 volt may be amplitude modulated 100% with a source of audio frequencies in the range of 30 cycles to 15 kilocycles having an amplitude of approximately 10 volts.

b. Measurements Corporation Part No. 80-ZH3, a 2:1 voltage ratio pad, (6db) input and output impedance 50 ohms, equipped with a male type-N connector at the input, and a female type-N connector at the output.

c. Measurements Corporation Part No. M-342, a 10:1 voltage ratio pad (20db), input and output impedance 50 ohms, equipped with a male type-N connector at the input, and a female type-N connector at the output.

d. Measurements Corporation Part No. 80-ZH4, a 4 ft. coaxial cable (RG-55/U) equipped with a male type N connector at one end and terminated with binding posts and a 50-ohm resistor at the other end.

e. Measurements Corporation Part No. 84-Z2-3, a 4 ft. coaxial cable (RG-8/U) equipped at both ends with male type-N connectors.

f. A wide-band oscilloscope is a convenient accessory to use in cases where it is desired to view the modulated wave. This oscilloscope should have a frequency response extending above 100 kilocycles, and a vertical deflection sensitivity of approximately 25 millivolts per inch.

CHAPTER 5

TECHNICAL SERVICE - MAINTENANCE INSTRUCTIONS

SECTION I

GENERAL

19. SCOPE:

a. The purpose of this chapter is to acquaint operating and maintenance personnel with the theory of operation of the various circuits in the Model 115.

b. Return the instrument to Measurements Corporation whenever repairs involving replacement of components is necessary.

SECTION II

CONDENSED THEORY OF OPERATION

20. GENERAL:

a. A block diagram of the Model 115 is shown in Figure 3. A complete schematic diagram is shown at the rear of this manual.

b. The Model 115 consists of an aperiodic modulator, a cathode-follower audio amplifier, a vacuum-tube voltmeter, and a regulated power supply.

21. POWER SUPPLY:

a. The power supply includes a full-wave rectifier, (6X4) a resistance-capacitance filter, and a voltage regulator tube (0A2).

b. Negative bias for the modulators is produced across the paralleled resistors R1 and R2 connected in the negative return lead of the power supply.

22. AUDIO AMPLIFIER:

a. One section of the 12AU7 is used as a cathode-follower amplifier to provide a high-impedance modulation-frequency input.

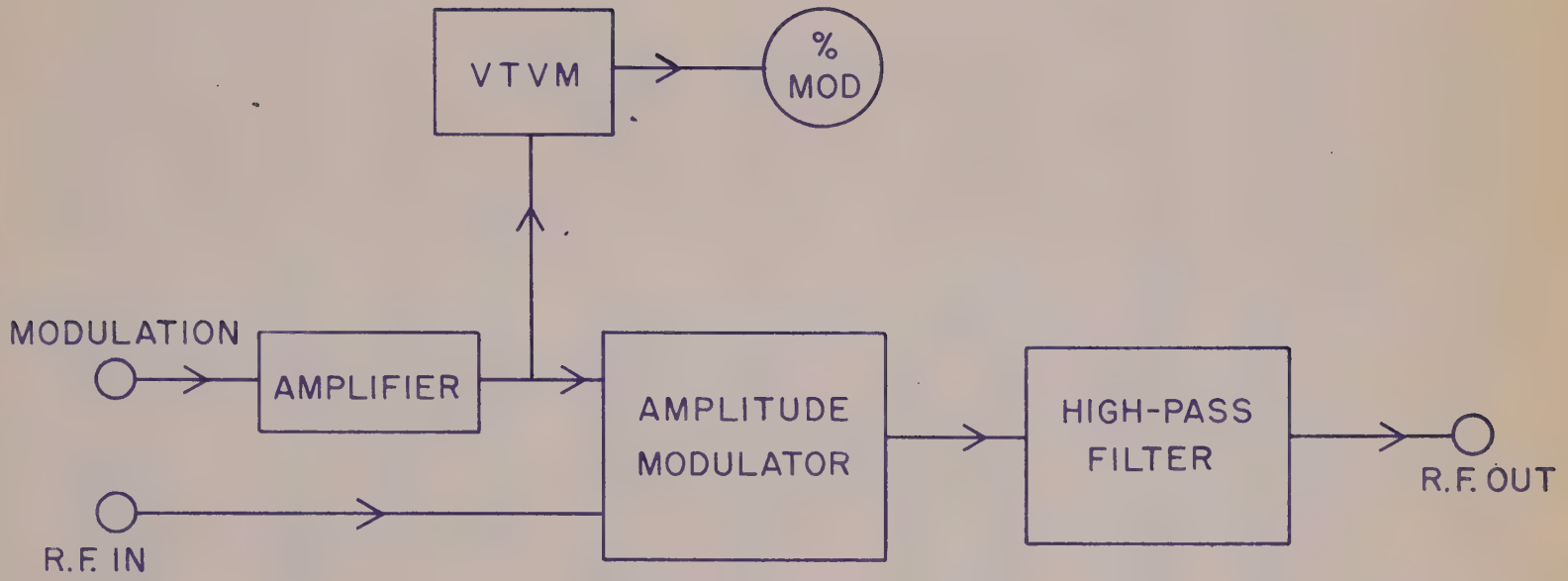


Figure 3. Block diagram of Model 115.

b. The cathode of the 12AU7 drives the primary of the audio-frequency transformer T2 which feeds balanced audio-frequency signals to the modulator tubes.

23. VACUUM-TUBE VOLTMETER:

a. One section of the 12AU7 serves as an amplifier for the vacuum-tube voltmeter. Its grid is directly coupled to the cathode of the audio amplifier described in Paragraph 22.

b. The % MOD CAL resistor R12 controls the gain of the vacuum-tube voltmeter and is set at the factory to the proper value to produce 100% modulation as indicated on the meter M1.

c. The plate of the 12AU7 is coupled through a 0.5 microfarad capacitor to one section of the 6AL5 which is connected as a shunt-type rectifier to the % MOD meter. The emission current of the rectifier is balanced out by the other section of the 6AL5 and the resistor R10.

24. MODULATOR:

a. A pair of 6BC4 tubes are connected in a symmetrical modulator circuit having a nominal output impedance of 50 ohms.

b. The carrier input is fed to the modulator tubes through the isolation transformer T3. This transformer is properly terminated to provide a nominal input impedance of 50 ohms.

c. The bias voltages on the 6BC4 tubes are factory adjusted by means of resistors R1 and R2.

d. When the tubes are properly biased, 100% modulation of the carrier is obtained with low distortion.

e. The modulator circuit is so arranged that the percent modulation is essentially independent of the magnitude of the carrier.

25. HIGH-PASS FILTER:

a. The output of the modulator is connected to a high-pass filter which has a nominal characteristic impedance of 50 ohms and a cut-off frequency of 100 kilocycles.

b. The filter prevents low-frequency modulation products from being fed to the output of the system.

SECTION III

TROUBLE LOCATION

26. LOCALIZING THE TROUBLE:

a. Trouble may be quickly localized by making the preliminary operational checks described in Paragraph 14 and by reference to TableIII, Tube Voltage and Resistance Chart.

b. To remove the case of the Model 115, lay the instrument face down preferably on a soft pad. break the seal in the cup washer on the bottom of the case and remove the screw. Next, unscrew the four rubber feet taking care not to damage them. Finally, lift the case off of the instrument taking due care to feed the power cord through the hole in the bottom of the case.

SECTION IV

PRE-ADJUSTMENT PROCEDURE

27. TEST EQUIPMENT REQUIRED:

a. The following equipment should be available for adjustment purposes:

(1) Measurements Model 82 Signal Generator (See Paragraph 18a).

(2) As an alternate for (1), use Audio Oscillator covering 30 cycles to 15 kilocycles.

Signal Generator covering 100 kilocycles to 50 megacycles.

(3) Cathode-ray Oscillograph having a frequency response extending above 100 kilocycles, and a vertical deflection sensitivity of approximately 25 millivolts per inch.

(4) Multimeter with d-c sensitivy of 20,000 ohms per volt.

(5) Connecting cables as described in Paragraphs 18d and 18e.

TABLE III. TUBE VOLTAGE AND RESISTANCE CHART

TUBE		PLATE			CONTROL GRID			CATHODE		
No.	Type	Pin #	Volts	Ohms	Pin #	Volts	Ohms	Pin #	Volts	Ohms
V1	6BC4	9	+140	150K	2	-4.5*	400	6	0	0
V2	6BC4	9	+140	150K	2	-1.5*	200	6	0	0
V3	6X4	1 6	AC-290 AC-290	700 700	-	-	-	7	+360	150K
V4	0A2	5	+140	150K	-	-	-	2 4	-9 -9	500 500
V5	12AU7	1 6	+90 +140	200K 150K	2 7	+5 0	1.5K 100K	3* 8	+10 +5	9K 1.5K
V6	6AL5	2 7	0 -8	0 51K	- -	- -	- -	1 5	0 +0.2	0 51K

* Factory setting will vary widely in different instruments.

NOTE: All measurements made from chassis ground.
DC voltages measured using a 20,000-ohms-per-volt meter.
AC voltages measured using a 1,000-ohms-per-volt meter.
Set in normal operating condition 100% 400-cps modulation.
Resistance readings with power and modulation removed.

SECTION V

ADJUSTMENT PROCEDURES

28. GENERAL:

a. The adjustment procedure outlined herein will not guarantee optimum performance from the Model 115, but it will yield satisfactory results for most applications. If failure of circuit components has rendered the modulator section of the Model 115 inoperative, the instrument should be returned to Measurements Corporation where specialized test equipment is available to adjust the modulator for optimum amplitude modulation conditions.

29. MODULATION LINEARITY:

a. Set up the equipment as outlined in Paragraph 14a through 14g.

b. The linearity of modulation can be checked by using the audio modulating voltage as a horizontal deflection voltage for the oscilloscope trace to produce a trapezoidal modulation pattern as described in Terman's "Radio Engineers' Handbook" page 989.

c. If the pattern obtained is not a clean trapezoid with straight sides, it may be necessary to remove the effects of phase shift between the modulation envelope and the horizontal deflection voltage by use of a phase-shifting network connected between the audio oscillator and the oscilloscope. The effect of phase shift may be removed in some cases by selecting an audio modulating frequency which produces no phase shift in the set-up.

d. When the audio modulating level is increased to produce 100% modulation, a clean triangular pattern should be obtained. If the sides of the triangle are curved, check to see that the bias of V1 is approximately -4 volts and the bias of V2 is approximately -1.5 volts.

e. Set % MOD for 100% modulation. Then adjust V1 Bias Adjustment (R1) and V2 Bias Adjustment (R2) simultaneously maintaining 100% modulation until a clean triangular pattern is obtained.

30. PERCENT MODULATION:

a. If necessary, adjust % MOD. CAL. (R12) to make 100% on the meter coincide with 100% modulation of the carrier as viewed on the oscilloscope. The audio voltage input to the grid (7) of V5 (12AU7) should be from 4 to 7 volts when properly adjusted.

APPENDIX I

1. STORAGE

a. Remove dust from controls and outer surface of instrument with a clean rag.

b. Wrap instrument in heavy wrapping paper and seal seams with gummed tape or similar adhesive.

c. Store in a dry place. If excessive humidity is unavoidable, the wrapped instrument should be placed in a moisture-proof bag with a sufficient quantity of drying agent, such as silica gel, to insure a dry atmosphere.

(1) When the use of bag and desiccant is necessary, the instrument should be checked at 6-month intervals to determine the effectiveness of the seal.

2. SHIPMENT

a. Wrap the instrument with heavy wrapping paper and seal seams with gummed tape or similar adhesive.

b. Place in fibre-board carton or wooden box large enough to permit at least 3 inches of excelsior or similar packing material between the instrument and sides of the box.

(1) For export packing, the instrument must be wrapped in waterproof paper and the seams sealed with glue or similar sealing compound before being placed in a wooden box.

APPENDIX II

TABLE OF REPLACEABLE PARTS

MODEL 115 AMPLITUDE MODULATOR

SYMBOL	DESCRIPTION	FUNCTION
C1A C1B	CAPACITOR: fixed; dry electrolytic; 2 sec.; 20-20 mfd.; 450 VDCW: 1" dia. x 3" lg.; metal case, hermetically sealed; 2 solder terminals for positive connections; common negative connection to shell; mounts on metal plate which has 2 holes .135 dia. on 1-1/2" centers. Measurements Corporation Dwg. H-5130.	Power supply filter capacitors
C2	CAPACITOR: fixed; paper; 0.25 mfd., +20% -10%; 600 VDCW; metal case; 1" x 1-5/8" x 1-13/16" lg.; oil impregnated; 2 #10-32 tapped inserts for electrical connection; one 1/4" dia. mounting hole. Measurements Corporation Dwg. H-5511.	R.F. by-pass for 51 ohm plate load of V1 - V2
C3	CAPACITOR: fixed; paper; 0.5 mfd.; ± 20%; 600 VDCW; metal case; 1-1/16" dia. x 2-13/16" lg.; oil impregnated; 2 axial wire leads. Measurements Corporation Dwg. H-5512.	Coupling Capacitor to diode plate of V6
C4	CAPACITOR: fixed; paper; 0.5 mfd; +20%, -10%; 400 VDCW; plastic case; 3/4" dia. x 2-1/4" lg.; 2 axial wire leads. Measurements Corporation Dwg. H-5513.	Blocking capacitor for external modulation input
C5	CAPACITOR: fixed; dry electrolytic; 250 mfd; 50 VDCW; metal case; 1-1/16" dia. x 2-7/8" lg.; 2 axial wire leads. Measurements Corporation Dwg. H-5514.	By-pass capacitor for bias adjust controls
C6	CAPACITOR: fixed; ceramic; 1000 mmfd; ± 20%; 500 VDCW; hermetically sealed; hook type terminals; 5/16" hex. x 7/8" lg.; mounts with 1/4-28 threaded bushing. Measurements Corporation H-5515.	Feed through by-pass capacitors

APPENDIX II

TABLE OF REPLACEABLE PARTS

MODEL 115 AMPLITUDE MODULATOR

SYMBOL	DESCRIPTION	FUNCTION
C7	CAPACITOR: Same as C6.	Same as C6
C8	CAPACITOR: fixed; paper; 0.05 mfd; 500 VDCW: 7/16" dia. x 1-1/4" lg.; 2 axial wire leads. Measurements Corporation Dwg. H-5516.	Filter capacitors for high pass filter
C9	CAPACITOR: Same as C8	Same as C8
C10	CAPACITOR: Same as C8	Same as C8
C11	CAPACITOR: Same as C8	Same as C8
C12	CAPACITOR: Variable; trimmer; 1-8 mmf. Meas. Corp. Part H-4114.	
E1	LAMP: incandescent; 6-8V.; 0.25 amp; bulb T3¼, clear; 1-1/8" lg. O.A.; miniature bayonet base; burn any position. Measurements Corporation Dwg. H-5016.	Pilot Lamp
F1	FUSE: 1/2 amp; slow acting; rated continuous for 110% load; opens in one hour at 135% load; opens in 25 seconds at 200% load; 250V; one time; glass body; metal ferrules; 1-1/4" lg. x 1/4" dia. Measurements Corporation Dwg. H-5018, Pt. 6.	Power Line Fuse
J1	CONNECTOR: AN Type UG-1052/U	RF input jack
J2	CONNECTOR: AN Type UG-58 A/U	RF output jack
L1	COIL: R.F.; filter choke; pie wound; inductance 70 uh; AC resistance 0.7 ohms at 100 Kc; 9/16" dia. x 1/2" lg; 2 wire leads; iron core coil form; center hole mounting for #4 screw. Measurements Corporation Dwg. H-5398.	Filter choke used in high pass filter assembly

APPENDIX II

TABLE OF REPLACEABLE PARTS

MODEL 115 AMPLITUDE MODULATOR

SYMBOL	DESCRIPTION	FUNCTION
L2	COIL: Same as L1	Same as L1
M1	METER: ammeter; D.C. type; 0-200 micro-amps; rect. bakelite case; panel mtg. type; barrel 2-3/4" dia. x 1" deep behind panel face; rect. flange 4-17/64" W x 3-31/32" h. x 45/64" d.; full scale accuracy within ± 2% of full scale value. D'Arsonval movement; 80 MV drop; 400 ohms across terminals; calibrated for non-magnetic panel; scale "PERCENT MODULATION"; black numerals, white background; red pointer; 4 mtg. holes 5/32" dia. at 3-5/8" horiz. x 3-5/16" vert. centers; 2 stud terminals 10-32 x 3/4" lg. max. spaced 1". Measurements Corporation Dwg. H-931.	Indicates percent modulation
P1	CONNECTOR: male contact; part of W1.	Provides connection to power source
R1	RESISTOR: variable; wire wound; 1,000 ohms ± 10%; 3 watt; 3 solder lugs; 1-21/32" dia. x 25/32" deep; moulded case; metal back; 1/4" dia. shaft extends 1/2" from mtg. surface; screw driver adj.; linear taper; mounting bushing 3/8" lg. x 3/8-32 thread. Measurements Corporation Dwg. H-5305.	Bias adjust for V1
R2	RESISTOR: Same as R1	Bias adjust for V2
R3	RESISTOR: fixed; 3,000 ohms ± 10%; 20 watt; wire wound; 9/16" dia. x 2-1/16" lg.; ceramic tube; moisture proofed; 2 solder tabs (project 5/8"); mount with 1-#8 screw through center. Measurements Corporation Dwg. H-5249.	Filter resistor for power supply
R4	RESISTOR: Same as R3	Same as R3

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TABLE OF REPLACEABLE PARTS

MODEL 115 AMPLITUDE MODULATOR

SYMBOL	DESCRIPTION	FUNCTION
R5	RESISTOR: fixed; composition; 150,000 ohms; ± 10%; 2 watt; 11/16" lg. x 5/16" dia.; 2 axial wire leads. Measurements Corporation Dwg. H-3734, Pt. 154.	Bleeder resistor for power supply
R6	RESISTOR: fixed; composition; 10 ohms; ± 10% .5 watt; 3/8" lg. x 9/64" dia.; 2 axial wire leads. Measurements Corporation Dwg. H-3728, Pt. 100.	Isolating resistor Plate supply of V1-V2
R7	RESISTOR: fixed; composition; 51 ohms; ± 5%; .5 watt; 3/8" lg. x 9/64" dia.; 2 axial wire leads. Measurements Corporation Dwg. H-3727, Pt. 510.	Plate load resistor for V1-V2
R8	RESISTOR: fixed; composition; 51,000 ohms; ± 5%; .5 watt; 3/8" lg. x 9/64" dia.; 2 axial wire leads. Measurements Corporation Dwg. H-3727, Pt. 513.	Plate load resistor for 1/2 of diode V6
R9	RESISTOR: same as R8.	Plate load resistor for 1/2 of V6
R10	RESISTOR: same as R8.	Cathode load resistor for 1/2 of diode V6
R11	RESISTOR: fixed; composition; 4700 ohms; ± 10%; .5 watt; 3/8" lg. x 9/64" dia.; 2 axial wire leads. Measurements Corporation Dwg. H-3728, Pt. 472.	Cathode resistor for meter amplifier section of V5
R12	RESISTOR: variable; 10,000 ohms; ± 10% wire wound; 3 watt; 3 solder lugs; 1-21/32" dia. x 25/32" deep; moulded case; metal back; 1/4" dia. metal shaft extends 1/2" from mtg. surface; screw driver adj; linear taper; mounting bushing 3/8" lg. x 3/8"-32 thread. Meas. Corp. H-5517.	Variable cathode resistor for meter amp. section of V5

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TABLE OF REPLACEABLE PARTS

MODEL 115 AMPLITUDE MODULATOR

SYMBOL	DESCRIPTION	FUNCTION
R13	RESISTOR: variable; composition; 100,000 ohms; 1 watt; clockwise log taper; 1/4" dia. shaft extends 1/2" from bushing; 3 solder lugs; moulded case; metal back; mtg. bushing 3/8" lg. x 3/8-32 thread. Measurements Corporation Dwg. H-5518.	Percent modulation gain control
R14	RESISTOR: fixed; composition; 110 ohms; ± 5%; .5 watt; 3/8" lg. x 9/64" dia.; 2 axial wire leads. Measurements Corporation Dwg. H-3727, Pt. 111.	Terminating resistor for R.F. Transformer
R15	RESISTOR: same as R14	Same as R14
R16	RESISTOR: fixed; composition; 5 ohms; ± 10%; .5 watt; 3/8 lg x 9/64" dia.; 2 axial wire leads. Measurements Corporation Dwg. H-5519.	Isolating resistor for plate of V1
R17	RESISTOR: same as R16	Isolating resistor for plate of V2
S1	SWITCH: toggle; S.P.S.T.; 3 amp.; 250 v.; phenolic body; 1-1/4" lg. x 11/16" w. x 21/32" deep; 1/2" lg. ball tipped handle; locking action; 2 solder lug terminals; single hole mtg.; bushing 15/32"-32 x 3/8" lg. Measurements Corporation Dwg. H-383, Pt. 1.	Makes and breaks power trans. primary conn. to power line
T1	TRANSFORMER: power; plate & filament type; imput 117 volts 50-60 ohms single phase; 3 output windings; sec. #1, 300-0-300 V. A.C. at 50 Ma. D.C. load.; 2 Red leads, and one red with yellow tracer lead; Sec. #2, 6.3V at 2.0 amp.; 2 green leads; Sec. #3, 6.3 V. at 2.0 amp.; 2 brown leads; shell type metal case; 2-1/2" x 3 x 3-3/8" high; mount with four #8-32 screws on 2" x 2-1/2" centers. Measurements Corporation Dwg. H-5405.	Supplies power for all tubes

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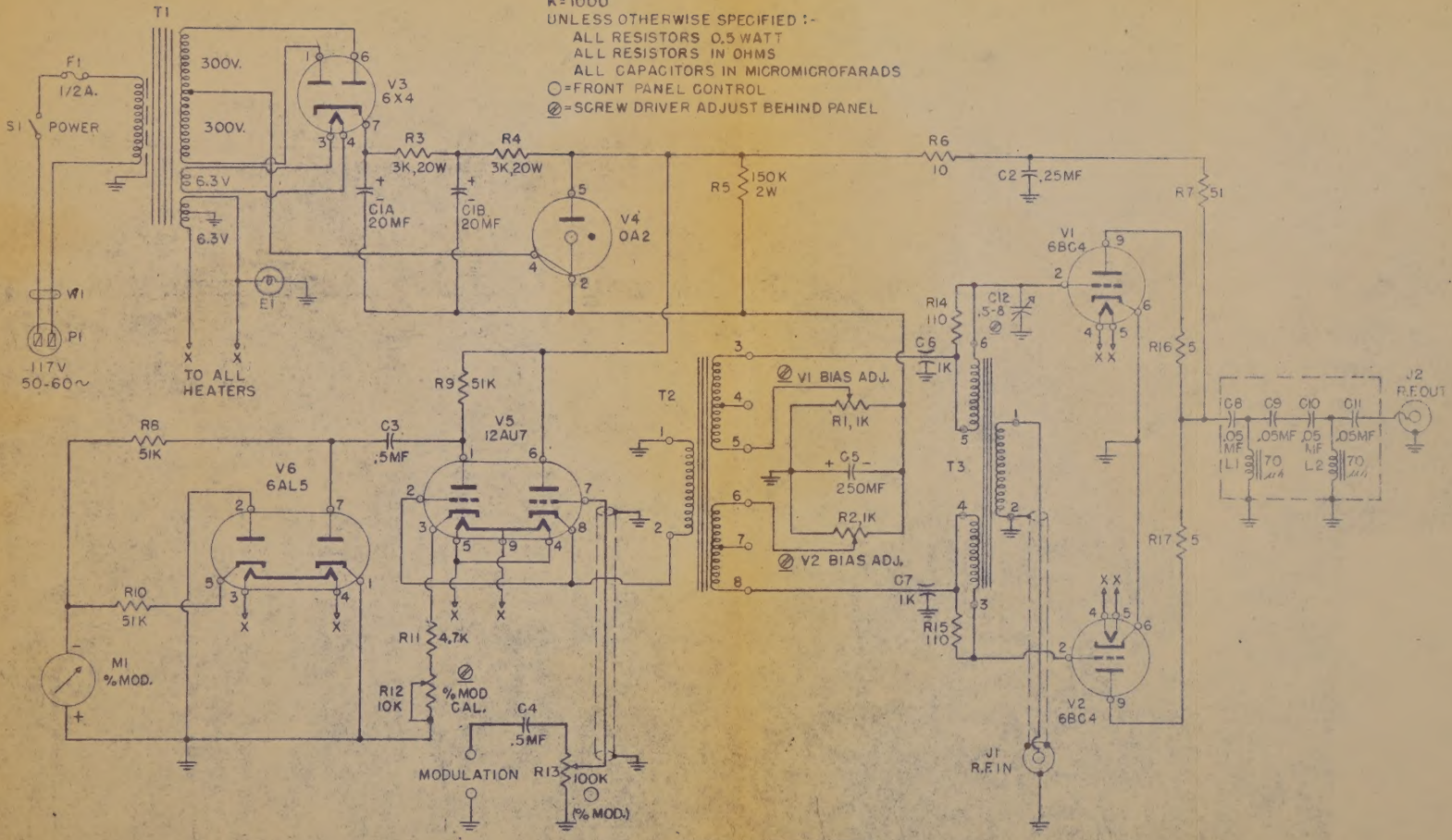
TABLE OF REPLACEABLE PARTS

MODEL 115 AMPLITUDE MODULATOR

SYMBOL	DESCRIPTION	FUNCTION
T2	TRANSFORMER: output; impedance of Pri. 15,000 ohms; sec. 600/150 ohms C.T.; metal case; 2-1/2" x 2-3/8" x 3-1/16" high; mounts with four #6-32 studs on 1-13/16 x 1-11/16 centers. Measurements Corporation Dwg. H-5520.	audio transf. used to supply balanced mod. voltage to grids of V1 to V2
T3	TRANSFORMER: R.F.; 6 leads; 1-1/16" dia. x 1-1/16" high; mounts by #6-32 stud. Measurements Corporation Dwg. H-4972.	RF transf; used to supply balanced r.f. voltage to grids of V1 - V2.
V1	TUBE: electron; RETMA #6BC4	R.F. modulator
V2	TUBE: electron; RETMA #6BC4	Same as V1
V3	TUBE: electron; RETMA #6 x 4	full wave rectifier for plate supply voltages
V4	TUBE: electron; RETMA #0A2	Voltage regulator tube; used to keep constant voltage
V5	TUBE: electron; RETMA #12AU7	Duo triode used for audio amp. and meter amplifier
V6	TUBE: electron; RETMA #6AL5	Duo diode used for rectification of signal for meter reading
W1	CABLE ASSEMBLY: power; 2 cond., #18 AWG.; 16 strands, #30 AWG; 6 ft. long; one end terminated in plug; other end not terminated. Measurements Corporation Dwg. H-704.	Provides connection to power source



SCHEMATIC DIAGRAM
MODEL 115

B-5380-F

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